

CLAIMS:

1. A polymer electrolyte fuel cell comprising a plurality of membrane electrode assemblies laminated via separators, each assembly comprising a membrane-form polymer electrolyte and a pair of a fuel electrode and an air electrode facing each other via the electrolyte, wherein the separator has a fuel gas channel for supplying a fuel gas to the fuel electrode, an oxidant channel for supplying an oxidant to the air electrode and a fluid channel for removing a heat generated by a reaction out of the cell system, and the separator is made of a metal/non-metal composite material which has faces made of non-metal which are in contact with the membrane electrode assemblies and side walls of the fluid channel which are made of metal.
2. The polymer electrolyte fuel cell according to Claim 1, wherein the separator comprises a layer made of non-metal having the fuel gas channel on its surface, a layer made of metal having the fluid channel internally and a layer made of non-metal having the oxidant channel on its surface, which are laminated, and the fuel gas channel and the oxidant channel are disposed on the surface of the separator.
3. The polymer electrolyte fuel cell according to Claim 1 or 2, wherein the metal is a member selected from the group consisting of a metal containing aluminum in an amount of at least 80%, a metal containing titanium in an

amount of at least 80% and stainless steel, and the non-metal comprises carbon material as the main component.

4. The polymer electrolyte fuel cell according to Claim 1, 2 or 3, wherein the non-metal is made of a highly 5 electrically conductive carbon material.

5. The polymer electrolyte fuel cell according to Claim 1, 2, 3 or 4, wherein the faces of the separator which are in contact with the membrane electrode assemblies, are composed of a molded body made of expanded graphite 10 particles.

6. The polymer electrolyte fuel cell according to Claim 4, wherein the separator is one wherein a layer made of a highly electrically conductive material is formed on both sides of the layer made of metal having the fluid channel 15 internally, by a printing method or a coating method employing a conductive paste containing the highly electrically conductive carbon material.

7. The polymer electrolyte fuel cell according to Claim 1, 2, 3, 4, 5 or 6, wherein a coating film containing 20 ceramics and having a resistivity of at most $3 \times 10^{-4} \Omega \cdot \text{cm}$, is formed on the surface of the side walls of the fluid channel.

8. The polymer electrolyte fuel cell according to Claim 1, 2, 3, 4, 5, 6 or 7, wherein a layer containing 25 ceramics and having a resistivity of at most $3 \times 10^{-4} \Omega \cdot \text{cm}$, is disposed at the interface between the metal and the non-metal.